PLASTIC CONTAINER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of copending PCT International Patent Application PCT/EP00/03643, filed April 20, 2000, and a continuation-in-part of copending U.S. Patent Application No. 09/525,526, filed March 15, 2000, the contents of both of which is expressly incorporated herein by reference thereto.

TECHNICAL FIELD OF INVENTION

The present invention relates to large-volume containers and, in particular, large-volume containers made from a thermoplastic material.

BACKGROUND OF THE INVENTION

Large-volume containers of the type discussed are typically in the form of a cylindrical drum having a capacity (volumetric net content) of about 16 to 80 gallons. These containers are commonly used for the storage and transportation of liquid contents or solid, particle-shaped and pasty contents.

A commonly employed container design is the bung-type drum with a net capacity of about 58 gallons. When these cylindrical drums or barrels are stored or shipped in ISO containers, there remains wasted space between the round wall surfaces of neighboring drums. Also, conventional drums of this type exhibit a tendency to buckle at their sides when multiple drums are stacked upon one another.

Therefore, it is desirable to provide a drum that avoids wasted space between adjacent drums, and at the same time does not tend to buckle when other drums are stacked upon it. The present invention provides such a drum.

SUMMARY OF THE INVENTION

According to the invention, this is accomplished by means of an approximately square cross-sectional shape of the drum body with slightly convex lateral surfaces and slightly radiused corners. Such a design results in a substantially improved utilization of pallet space. Compared to conventional, round drums, the essentially square drums according to this invention, when stacked side-by-side, leave significantly smaller gaps between them, thus permitting enhanced utilization of previously wasted carrier space (for instance in ISO containers). In a practical implementation of this invention, the lateral walls of the drum are provided with reinforcing vertical and/or horizontal ribs which will

substantially reduce the tendency of the flat lateral wall panels to bulge or buckle. This buckling tendency increases as a function of the internal pressure, building up due to the hydrostatic pressure of the liquid contents, the weight of stacked drums, or the like. The reinforcing ribs may be in the form of molded-in U- or V-channels facing and protruding inward and/or outward.

In one embodiment of this invention, a sturdy drum body is obtained by means of continuous circumferential reinforcing elements in the form of enlarged annular wall protrusions. These reinforcing annular wall protrusions are preferably produced by an upset-stamping process during the blow molding of the drum body. In order for the upset-stamping-produced reinforcing rings to retain roughly the same outer diameter as the remaining drum wall, they are configured as a continuous, circumferential, fairly flat V-shaped outward-facing indentation.

In another preferred embodiment, the corners of the drum body are provided with deep angular indentations in such fashion that in the appropriate horizontal plane the drum has a nearly circular cross-section. This embodiment as well results in a considerable reduction of the buckling tendency especially in the lower half of the drum, thus permitting high stacking loads.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further explained and described below in the drawings of the embodiments that are presented. The following is shown:

FIG. 1 is a top view of a square drum-type container according to the present invention;

FIG. 2 is a side view of a square drum-type container according to the present invention, with the right side showing a partially cross-sectional representation of the upper and lower segments taken along line A-A of FIG. 1, and the left side showing a partially cross-sectional representation of a different embodiment according to the present invention;

FIG. 3 is a cross-section through the body of a square drum-type container according to the present invention, showing a circular footprint for comparison;

FIG. 4 is a side view of a modified drum according to this invention, with a partially cross-sectional representation of the upper and lower segments;

FIG. 5 is a top view of a preferred embodiment of the invention;

FIG. 6 is a side view of the container of FIG. 5, with a partially cross-sectional representation of the upper and lower segments;

FIG. 7 shows a diagonal cross-section of the drum of FIG. 5 taken along line B-B;

FIG. 8 illustrates the handling of a drum according to the present invention, lying sideways;

FIG. 9 illustrates the handling of a tipped drum according to the present invention; and

FIG. 10 is a top view of four palletized drums according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference number 10 shows a large-volume blow molded bung container made of thermoplastic material in FIG. 1 with a capacity of approximately 66 gallons, which is equipped on the upper wall of the container with a carrying and transport rim, or L-ring 12, that runs around the circumference of the container. L-ring 12 serves as a handling ring for lifting the drum with typical drum handling equipment. In the first end wall of the drum 10 are located two side bungs 14 in die-sunk, recessed bung wells 16. In this top view, the square cross-section becomes clear, namely that the drum bottom exhibits a sectional surface that approximates the shape of a square with side surfaces or side wall sections that are slightly embossed and rounded corner sections.

FIG. 2 shows an embodiment with a bung 14 centrally located in a bung well 16. In an alternate configuration, the drum 10 can have a larger, screw cap-equipped fill/drain opening with a larger diameter of, for instance, 6 inches or 10 inches. A screw cap-equipped drum 10 of that type is ideally suited as a reusable container for viscous, pasty or granular bulk material. According to one embodiment, the fill/drain opening may be centrally located on the top surface, or first end wall, of the drum 10. In the left half of the picture, the drum 10 is equipped with a reinforcing ring, or rolling ring 18, that runs around the circumference of the drum and allows it to be rolled over the floor, while in the right half of the picture, another embodiment without a rolling ring is shown.

FIG. 3 shows a cross-section through the wall of a drum body according to this invention, which drum can be designed with a loose lid. For comparison to the cross-section, a circle with the same circumferential length is superimposed over it. This circle is intended to show the usual bulging-out tendency of a drum filled with content. The internal pressure that builds up inside the drum 10 would cause the flat walls to bulge outwards while pulling in the corners, taking on the shape of the least structural stress, that being a

circle. To work against this disadvantageous tendency, the drum body is provided with a continuous horizontal reinforcing element, as shown in FIG. 4.

To resist buckling of the side walls and to increase stackability, drum 10 is configured with at least one reinforcing element disposed about its circumference. In the left half of the illustration in FIG. 4, the reinforcing element is an annular protrusion 22 that runs around the drum's circumference. In the right half of the illustration, the reinforcing element is in the form of inward corner indentations 24. In either configuration, the reinforcing element (annular protrusion 22 or corner indentation 24) is measured at a height of about 43% from the drum 10 bottom, i.e., at the point where the square drum 10 is exposed to maximum buckling pressure. The annular protrusion 22 is configured as a shallow V-shaped, continuous indentation in such a fashion that the diameter of the annular protrusion 22 is roughly the same as that of the remaining drum body. Alternatively, the annular protrusion 22 can stick out slightly so that drums standing next to one another touch each other by way of the annular protrusion 22. In an alternate embodiment, drum 10 can be configured with any number of reinforcing elements disposed about its circumference.

FIG. 5 is a top view of the preferred embodiment of the drum 10. This embodiment of drum 10 has a first portion with a generally square cross-section, and a second portion with a generally round cross-section defined by four angular corner indentations 24 formed in the drum. The angular corner indentations 24 are outlined by the round dashed line, and are thickest in the corner areas and transition into the flat surfaces of the side wall sections in between.

In the preferred embodiment of FIG. 5, the second portion of the drum 10 has a nearly circular cross-section in the horizontal plane of maximum continuous indentation. Referring to the outline of the generally square drum 10, the ratio between the long radius 36, which is measured toward the corners, and the short radius 38, which is measured toward the midpoint of the side walls, is between 1.05 and 1.34 and preferably about 1.22.

As also shown in FIG. 5, drum 10 has on its top surface, or first end wall, two molded-in, mutually parallel reinforcing ribs 28. Reinforcing ribs 28 act to reinforce the upper surface of drum 10. In an alternate embodiment, any number of reinforcing ribs could be added to the top surface in varying orientations with respect to one another.

FIG. 6 shows the axial indentations 26 (axial reinforcing ribs) in the middle of the side wall sections of the square drum 10, serving to reinforce and stabilize the filled drum 10 against any buckling or bulging when subjected to stacked loads or internal pressures. In this particular embodiment, in contrast to a conventional square container

such as a thin-walled canister, it is the flat side wall sections that support the axial load while the corner indentations 24 prevent any excessive radial bulging. The indentations 26 as well as reinforcing ribs 28 can be in the form of molded-in U- or V-shaped indentations or protrusions that face inward and/or outward.

FIG. 7 shows a diagonal cross-section of drum 10. In this case, the container with the angled indentations 24 and smaller corners has the largest overall cross-section. It is evident from this illustration how much more volumetric capacity (10%) is obtainable when compared to a cylindrical drum.

FIG. 8 shows a drum 10 according to this invention firmly lying in a sideways position 30. Without an external force, the drum 10 will not roll away in an uncontrolled fashion, yet the rounded corners allow it to be rolled and moved.

FIG. 9 shows how the drum 10, when tipped, can be rolled in its slanted position 32. In this slanted position even manual manipulation and rolling of the drum 10 using the rolling ring 18 is entirely possible without much of an effort.

FIG. 10 shows four square drums set on a standard-34 pallet (45 inches x 45 inches), with maximum utilization of the space between the drums. Thus, when drums according to this invention are stacked in an ISO container, for instance when shipped by truck, about 10% more bulk material can be shipped in the same space and at the same cost of transportation.

While it is apparent that the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that numerous modifications and embodiments may be devised by those skilled in the art, and it is intended that the appended claims cover all such modifications and embodiments as fall within the true spirit and scope of the present invention.